تم الرفع بواسطة م. معن أبوعيسى

Specialization:	Electrical Engineering		Palestinian National Authority Ministry of Education & Higher Education Palestine Technical University College of Engineering & Technology second First Exam semester 2010/2011
Course Name:	Electrical Machine 1		
Date:	16/03/2011		
Time:	11:00-12:00		
Instructor:			

Name:	[redacted]	Section:	٩-٨	36 /50

Notes: (Answer **all** questions)

Mark 36/50

Question #	1	2	3	Total Grade
Grade				

د. أنيس ابو سنينة

Q1) (15 points) (10.5

Choice the correct answer:

1- The unit of the flux density is
(a) Tesla (b) H/m^2 (c) Wb/m (d) All three are equivalent

2- Interpoles in a dc motor must be:
(a) series excited and should have polarity opposite to that of the next main pole in the direction of rotation of armature
(b) series excited and should have same polarity as that of the next main pole in the direction of rotation of armature
(c) shunt excited and should have polarity opposite to that of the next main pole in the direction of rotation of armature
(d) shunt excited and should have same polarity as that of the next main pole in the direction of rotation of armature

3- 'A current-carrying wire produces a magnetic field in the area around it' is called
(a) Ampere's law (b) Electrodynamic force effect law
(c) Faraday's law of electro magnetic induction at rest

4- The armature reaction is
(a) the effect of the main field upon the armature MMF field.
(b) the effect of the armature MMF field upon the pole flux.
(c) the effect of series MMF field upon the shunt MMF field.

5- Compensating windings in dc motors are:
(a) shunt excited to aid the main poles at any load
(b) shunt excited to cancel armature reaction at any load
(c) series excited so that armature reaction is aided at any load
(d) series excited for cancellation of armature reaction ampere-turns at any load

6- The magnetizing intensity H is
(a) directly proportional to magnetomotive force and core length
(b) directly proportional to magnetomotive force and indirectly to core length
(c) indirectly proportional to magnetomotive force and core length

$H = \frac{Ni}{l_c}$

7- In a dc generator, a voltage is induced due to:
(a) applied torque on the shaft according to Faraday's law at motion
(b) applied torque on the shaft according to Faraday's law at rest
(c) applied torque on the shaft according to force effect law



Fig. 1

8- The current carrying coil appearing in Fig. 1 is rotating in the
(a) clockwise direction (b) counterclockwise direction (c) none

9- In a dc motor, the commutator function is

(a) to convert the interior alternating signal into dc signal

(b) to convert the dc signal into alternating signal

(c) to convert the armature winding in series between two poles

10- The core losses of electrical machines comprise:

(a) hysteresis loss only (b) copper loss only

(c) eddy current and hysteresis losses (d) both eddy current and copper losses

Q2) (18 points)

In Fig. 2, assume a 5% increase in effective air-gap area to account for fringing.

a) How much current (i) is required to produce an air gap flux density of **0.5 T**?

$L_c = 160$ cm

$R_1 = \frac{L_c}{\mu A} = \frac{1.6}{2500 * 4\pi \times 10^{-7} * 1 \times 10^{-4}} = \frac{1.6}{3.1416 \times 10^{-7}} = 5092958$ A·t/wb



Fig. 2

$R_2 = \frac{0.006}{4\pi \times 10^{-7} \times (1 \times 10^{-4}) * 1.6096} = \frac{0.006}{2.02 \times 10^{-10}} = 29702970.3$ A·t/wb.

$R_{total} = 29702970 + 5092958 = 34795928.3$ A·t/wb.

$\phi = BA_g = 0.5 * (1 \times 10^{-4} \times 1.05) = 5 \times 10^{-5}$ wb

$F = \phi R = 5 \times 10^{-5} * 34795928.3 = 1739.7$ turn.A

$F = Ni \Rightarrow 1739.7 = 1000 i \Rightarrow i = 1.739$ A.

i for the gap: $\phi = 0.5 * 1.6092 = 0.8045$ wb

$F = \phi R = 0.8 * R_2 = 23906435.4$ t.A

$\Rightarrow F = Ni \Rightarrow 23906435.4 = 1000 i \Rightarrow i = 23906.4$ A

b) If the conductor in Fig.2 carries a current of **5 A**, find the induced force on it and its direction of motion.

$F = iLB = 5 * 1.6 * 0.5 = 4$ N to the right →

Q3) (17 points)

For the loaded linear dc motor in Fig. 3:

a) Determine the direction of the current and the polarity of the battery voltage V_B on Fig. 3, if $V_B = 30$ V.

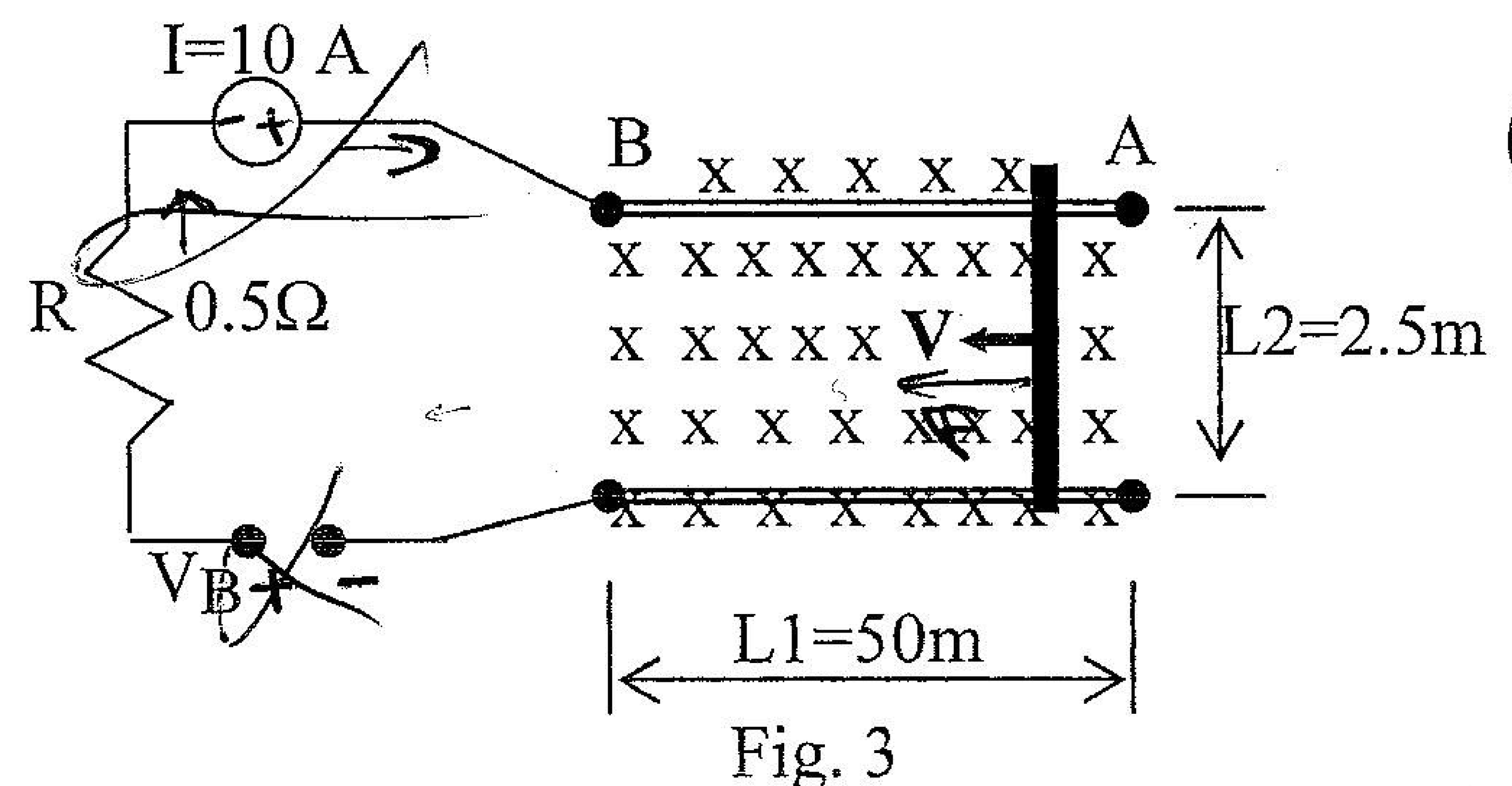


Fig. 3

b) Determine the values of force and speed (B=1.2T)

$F = iLB = 10 * 2.5 * 1.2 = 30$ N

$-V_B + e_{ind} + iR = 0$

$e_{ind} = V_B - iR = 30 - (10 * 0.5) = 30 - 5 = 25$ V

so new steady state =

$V_{ss} = \frac{25}{LB} = \frac{25}{1.2 * 2.5} = \frac{25}{3} = 8.3$ rad/second

c) Calculate the time required for traveling from point A to B under condition b).

$v = \frac{dr}{dt} \Rightarrow v\,dt = dr$

$\int v\,dt = \int dr$

$vt = r \Rightarrow 8.33t = 50 \Rightarrow t = \frac{50}{8.33} = 6$ second

d) Assume the bar is unloaded. How fast will the bar go now?

there is no load so $e_{ind} = V_B \Rightarrow v_{ss} = \frac{30}{LB} = \frac{30}{2.5 * 1.2} = \frac{30}{3} = 10$ rad/s

(End of Exam)